HOUSE OF COMMONS SESSION 1998–99

SCIENCE AND TECHNOLOGY COMMITTEE

Third Report

SCIENTIFIC ADVISORY SYSTEM: MOBILE PHONES AND HEALTH

Volume I

Report and Proceedings of the Committee

Ordered by The House of Commons *to be printed*
2 September 1999
Pursuant to Standing Order No. 137

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HOUSE OF COMMONS SESSION 1998–99

SCIENCE AND TECHNOLOGY COMMITTEE

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The Science and Technology Committee is appointed under Standing Order No. 152 to examine the expenditure, administration and policy of the Office of Science and Technology and associated public bodies.

The Committee consists of 11 Members. It has a quorum of three. Unless the House otherwise orders, all Members nominated to the Committee continue to be Members of it for the remainder of the Parliament.

The Committee has power:

(a) to send for persons, papers and records, to sit notwithstanding any adjournment of the House, to adjourn from place to place, and to report from time to time;

(b) to appoint specialist advisers either to supply information which is not readily available or to elucidate matters of complexity within the Committee's order of reference;

(c) to communicate to any other such committee and to the European Scrutiny Committee, to the Committee of Public Accounts, to the Deregulation Committee and to the Environmental Audit Committee its evidence and any other documents relating to matters of common interest; and

(d) to meet concurrently with any other such committee for the purposes of deliberating, taking evidence, or considering draft reports or with the European Scrutiny Committee or any sub-committee thereof for the purposes of deliberating or taking evidence.

The following were nominated Members of the Committee on 14 July 1997:

Mr David Atkinson
Mr Nigel Beard
Dr Michael Clark
Mrs Claire Curtis-Thomas
Dr Ian Gibson
Dr Lynne Jones
Mr Nigel Jones
Dr Ashok Kumar
Mrs Caroline Spelman
Dr Desmond Turner
Dr Alan W Williams

Dr Michael Clark was elected Chairman on 30 July 1997.

On 22 June 1998 Mrs Caroline Spelman was discharged from and Mrs Jacqui Lait added to the Committee.

On 30 November 1998 Mr David Atkinson was discharged from and Mr Ian Taylor added to the Committee.

On 5 July 1999 Mrs Jacqui Lait was discharged from and Mr Robert Jackson added to the Committee.

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SUMMARY OF RECOMMENDATIONS AND CONCLUSIONS

(a) **We recommend that the Government adopt the International Commission on Non-Ionising Radiation Protection recommended guideline limits for microwave exposure as a precautionary measure. We further recommend that these guidelines be introduced quickly but with a grace period to allow network operators to achieve full compliance (paragraph 22).**

(b) **We reject the main criticisms of the National Radiological Protection Board. Whilst the National Radiological Protection Board's guidelines for maximum microwave exposures are significantly higher than those found in some other countries, their scientific justification is largely unchallenged. Other bodies including the International Commission on Non-Ionising Radiation Protection, a European Expert Group and the World Health Organisation, agree with the National Radiological Protection Board's assessment that there is no scientific basis for exposure limits to avoid potential harm from athermal effects of microwaves (paragraph 28).**

(c) **We recommend that the National Radiological Protection Board regularly reviews the scientific evidence for athermal effects (paragraph 29).**

(d) **The establishment of the Expert Group on Mobile Phones is a highly appropriate response from Government but we view it as a temporary measure. In the long term, Government and the National Radiological Protection Board must ensure that the Advisory Group on Non-Ionising Radiation has sufficient resources to discharge its duties effectively and in a timely manner. We regard this as a responsible recognition by Government that constant vigilance is required in a rapidly changing field (paragraph 31).**

(e) **We recommend that, while they should not be in the majority on the proposed Expert Group, if industrial representatives have useful, relevant expertise, they should be included (paragraph 32).**

(f) **We recommend that there should be at least two lay members of the Expert Group, as recommended in our previous report (paragraph 33).**

(g) **Greater clarity in the rôle of lay members on advisory bodies and working groups is required. We recommend that their rôle be clearly set out, in advance of appointment, in terms of bringing alternative perspectives to bear and holding up scientific assumptions to proper scrutiny. To perform effectively lay members may need some specialist knowledge. The rationale for their appointment must be made clear (paragraph 34).**

(h) **We agree that there is a "need to confirm or deny the work on microwave-induced DNA fragmentation". We note with approval that industry is co-operating with the World Health Organisation and the European Union's fifth framework programme to determine priorities for a collaborative research programme to examine athermal effects of non-ionising radiation and endorse the need for this (paragraph 35).**

(i) **We agree with the Royal Society of Canada that the evidence for neurological problems reportedly caused by mobile phones, including symptoms such as headache, nausea, tiredness, sleep problems and memory loss, is unclear but there is sufficient anecdotal evidence and uncertainty to justify further research (paragraph 36).**

(j) **We believe that the level of publicly-funded research into the effects of microwave emissions falls short of an adequate programme into an area where public health**

implications should be regularly reviewed. We recommend that the Government ensures that a higher priority is given to a research programme into the health impacts of mobile phones. The public health aspects of new technologies should be incorporated into the Foresight Programme (paragraph 37).

(k) **It is essential that there is an independent and appropriately-funded research programme which is seen to be objective and which is seen not to be directed by commercial interests, even if industry makes a contribution, to the funding (paragraph 39).**

(l) **We recommend that the industry and the National Radiological Protection Board explore ways in which the design of mobile phones might limit personal exposure to radiation as a means of assisting consumer choice (paragraph 40).**

THIRD REPORT

The Science and Technology Committee has agreed to the following Report:—

SCIENTIFIC ADVISORY SYSTEM: MOBILE PHONES AND HEALTH

PREFACE

1. The Chief Scientific Adviser to the Government, Sir Robert May, was right in stating that "Science is playing an increasingly influential rôle in contributing to the formulation both of UK and international ... policy and regulatory decisions".[1] Scientific advice is used to underpin Government policy and decision-making in a broad range of fields, particularly those which relate not only to health, public safety, and environmental protection but also to other policy areas such as transport. Government needs to ensure that the mechanisms which it has in place can provide timely and effective scientific advice. All new technologies can raise new and sometimes challenging issues. The scientific advisory system must identify and define the issues and equip Government with the means to make well-informed decisions in matters of public policy and to communicate reliable information to the public about associated risks and uncertainties.

2. We decided to conduct our inquiry into the scientific advisory system through a number of case studies. This is the second. The first, which examined the scientific advisory system in relation to genetically modified foods, was published in May 1999.[2]

3. We did not set out to resolve all the questions arising from the rapid increase in the use of mobile phones or the proliferation of transmitter base stations. Rather, we used the issue of the radiation associated with mobile phone communications, both handsets and base stations, to test the way in which the scientific advisory system contributes to the development of Government decisions and policy.

4. There are guidelines setting maximum exposure levels which apply both to handsets and transmitter base stations. Despite this, the majority of health concerns have centred on the siting of masts. Those living or working close to the masts rarely have any personal choice in the matter, unlike those who choose to use handsets. Operators of any installation or equipment which generates electromagnetic fields must abide by the Health and Safety at Work Act. They have responsibility to assess any risk to health and safety which may arise, including the assessment of likely exposure levels, and to take appropriate measures. This includes the provision of advice for the protection of the public. Operators have to carry out risk assessments which are then used to ensure compliance. If the assessment shows that there is an area around the base station where people may be exposed to fields in excess of the guidelines, operators must restrict access to the area. Local residents may have objections to masts being sited in their locality on environmental or other non-scientific grounds but these are beyond the scope of our study.

Conduct of the Inquiry

5. In two oral evidence sessions we have heard from five sets of witnesses. Their evidence was supplemented by some 30 written submissions which reflected a broad range of opinion. We are grateful to all those who have assisted us during our inquiry either through oral or written evidence. We would also like to thank our specialist advisers for this inquiry: Professor Derek Burke, former Vice-Chancellor of the University of East Anglia and Professor Michael Elves, former Director of the Office of Scientific and Educational Affairs, Glaxo Wellcome plc.

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[1] Sir Robert May, *The Use of Scientific Advice in Policy Making*, Office of Science and Technology, March 1997, p.1.

[2] *Scientific Advisory System: Genetically Modified Foods,* Science and Technology Committee, First Report, Session 1998-99, HC 286–I.

INTRODUCTION

Mobile Phones and How They Work

6. Mobile phones are low-power radio devices which transmit and receive radio frequency (RF) signals, which fall in the microwave region of the electromagnetic spectrum. In the UK these signals are typically around either 900 Megahertz (MHz) or 1800 MHz. Mobile phone systems are dependent on microwave communications between handsets and fixed transmitter base stations which operate at the same wavelength but higher power levels. Each base station covers a specific area, or 'cell'. As a person using a mobile phone moves from one cell to another the controlling network switches communications from one base station to the next.

The Mobile Phone Industry

7. There are several mobile phone manufacturers, many of them household names such as Motorola, Ericsson, Nokia and Sony, and a wide range of models is available. The phones are frequently sold as part of a package which includes connection to a network. There are four network operators in the UK and three system standards: Vodafone and BTCellnet operate systems based on the analogue Total Access Communications Standard (TACS) and the digital 900 MHz Global System Mobile (GSM) standard, and Orange and One-2-One operate systems based on the digital 1800 MHz GSM standard.

8. As the number of mobile phones in use increases, so network operators must build more base stations to manage the increase in call traffic. In rural areas, where there is a lower user density, base stations are typically two kilometres apart. In towns and cities where there are more users the cells are smaller and transmitter base stations can be as little as a few hundred metres apart.[3] There are now some 20,000 base stations in the UK, some of which are located on transmitter masts shared by more than one operator.

9. Technological change can occur rapidly in this sector. The introduction of digital GSM systems in the early 1990s brought improvements in communications quality and, unlike analogue systems, GSM phones automatically adjust the power output to the minimum required to maintain communications.[4] Next year the Government intends to auction licences to operate the third generation of mobile phones with a new standard: the Universal Mobile Telephony System (UMTS) for introduction in 2002.[5] TACS is due to be phased out by 2005.

Benefits

10. Mobile phones offer both social and economic benefits. The sheer size of the industry in the UK, which currently employs over 100,000 people and contributes around £5 billion to the UK's GDP, demonstrates its important contribution to the UK economy.[6] Motorola alone employs over 10,000 people in the UK, had UK sales of £3.3 billion in 1998 and is in the top ten UK exporters.[7] Vodafone, following its merger with Airtouch Communications, is now the second largest UK company in terms of its market capitalisation of around £70 billion, and has interests in 23 countries.[8] Recent growth in the mobile phone market has been dramatic. In 1998 the market grew by 54% and mobile phones were the most popular Christmas gift.[9] In the first quarter of 1999, the industry acquired almost 20,000 new customers each day.[10] Telecommunications is important as an industry sector in itself but is also part of an essential infrastructure upon which other businesses and services depend. Orange plc, for instance, pointed out that mobile phones are now important business tools which contribute to improved

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[3] Ev. p. 74.

[4] Ev. p. 30.

[5] Ev. p. 121. UMTS will operate in the 2 GHz band.

[6] Q. 108; Ev. p. 21.

[7] Ev. p. 24.

[8] Ev. p. 28.

[9] Q.13.

[10] Ev. p. 21.

communications and productivity and that they are increasingly used for data as well as voice transmission.[11]

11. The most persuasive evidence that the public perceive a benefit from mobile phones is that so many choose to buy them and use them so frequently. It is estimated that there are now 16 million users in the UK, representing roughly 25% of the population.[12] The flexibility offered by mobile telephony, price convergence between mobile and standard networks and the introduction of UMTS, which will offer global coverage and a range of additional services, indicates that the market will continue to grow. It has been estimated that by 2000, 50% of all calls in the European Union (EU) could involve a mobile phone.[13]

ISSUES ARISING FROM THE GROWTH IN MOBILE PHONE USE

12. The widespread introduction of any new technology needs to be accompanied by a thorough analysis of the risks that it may pose. The scientific advisory system has a rôle to play in the identification, evaluation and minimisation of those risks. Nevertheless, by their very nature scientific advisory bodies work in areas of uncertainty. It is rarely possible to offer the clear-cut answers that Government, the press and public may seek. When associated benefits are perceived as negligible or accruing to others, the public can be intolerant of unquantifiable risks associated with new products, however negligible—as shown by the public response to the introduction of genetically modified foods. Mobile phones are seen by the public to offer a tangible and significant benefit, as the volume of sales testifies, but although benefits may offset risks, they do not eliminate them and some genuinely-held concerns remain. We recognise however that it is impossible to prove a negative. No matter how much research is done, it will never be possible to prove that something is not harmful. Scientific research can say that there is no evidence of risk or it can demonstrate that any risk is very low, but it cannot produce evidence of no risk. Nevertheless, in contrast to the negative impact of concerns about the safety of genetically modified food on sales, media stories highlighting possible hazards associated with the use of mobile phones have not prevented high sales growth. Public hostility is more often directed against transmitter masts in residential areas.

Perceived Health Hazards

IONISING AND NON-IONISING RADIATION

13. The electromagnetic spectrum ranges from high-frequency gamma rays at one end to low frequency radio waves at the other. Radiation at high frequencies can break down chemical bonds and is known as ionising radiation. In biological tissues this may cause damage to deoxyribonucleic acid (DNA)[14] and can lead to cancer. On the other hand, RF radiation, including microwave radiation, has much lower frequencies and is termed non-ionising radiation; because the lower energy levels associated with RF radiation are insufficient to break chemical bonds, they are not a health threat through ionisation.[15] We are all regularly exposed to RF radiation from a variety of sources. Besides mobile phone systems, common sources of radio waves include television broadcasts which in the UK operate at frequencies between 400 MHz and 860 MHz and microwave communication links (dishes) which operate at frequencies above 1000 MHz.

THERMAL EFFECTS OF NON-IONISING RADIATION

14. Microwave radiation can cause heating in biological tissues in much the same way as food is heated by a microwave oven. This thermal effect of microwave radiation can cause disruption to biological processes and tissue damage if the intensity is too high. The intensity of radiation from mobile phones is a small fraction of that emitted by microwave ovens, which typically

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[11] Ev. p. 56.

[12] Ev. p. 21.

[13] ACTS Bulletin No. 11, p.1.

[14] DNA: Deoxyribonucleic Acid, the molecule which makes up genetic material. Many cancers are initiated by damage to DNA. See: Dr Metters, Deputy Chief Medical Officer, Q. 11.

[15] See: *Moulder et al. Radiation Research*, vol 151, pp 513–531, 1999.

operate at a frequency around 2450 MHz, but the radiation is directed to the head when the phone is held to the ear in normal use. The current guidelines for maximum exposure to microwaves are intended to avoid harmful heating from the phones or the masts. Under existing regulations, all phones on the market are required to emit microwaves at an intensity low enough to avoid causing a damaging level of localised heating. Similarly, the transmitter bases are required to emit microwaves at an intensity low enough to avoid causing a damaging level of total body heating in humans who pass by the masts. Patterns of mobile phone usage have, however, altered since the guidelines were established. It has been suggested that as mobile phones are now used for sustained periods, "the question of length of exposure may need to be considered as a factor in determining whether such exposures could be harmful".[16]

ATHERMAL EFFECTS OF NON-IONISING RADIATION

15. Some concerns which have been raised do not relate to the known and relatively well-understood heating caused by microwave radiation but rather to possible so-called 'athermal' effects. Some studies have shown that RF radiation may have other biological effects, for example on brain tissue and the immune system, and transient effects on behaviour. The biological significance of such effects is as yet unclear;[17] and there is no conclusive evidence to show that these effects operate in the whole organism.

The Regulatory and Advisory Rôles of Government

16. The 'precautionary principle' is recognised by European Governments in the Maastricht Treaty and forms the basis of both EU and UK regulation in this area.[18] Under a strict application, it would not be possible to balance the risks of harm with the benefits of technological advances, since even a small degree of uncertainty or a suspicion of possible harm, no matter how ill-judged, would be enough to prohibit the introduction of a new technology. This interpretation is not, however, sustainable; it would preclude the application of almost any significant development as almost all innovations may have hidden or unknown risks. In practice, therefore, applying the precautionary principle means measures must be taken to minimise known risks and alertness to the emergence of unknown risks must be maintained.

17. Regulation of the mobile phone industry rests with the Department of Trade and Industry (DTI), which has the responsibility for licensing the network operators under the Telecommunications Act 1984 and also for the safety of consumer products while the Department of Health is responsible for protecting public health. Licensing of mobile phone operations is not, however, conditional on compliance with any radiation safety standards.[19] Under the General Product Safety Regulations 1994 it is an offence to supply unsafe consumer products.[20] These regulations are enforced by local authority trading standards officers who have the power to remove unsafe products from sale. Safety assessments of mobile phones take maximum microwave exposure guidelines into account.[21] Protection of people at work (and the public as a result of work activity) against possible health impacts of mobile phones and their masts is the responsibility of the Health and Safety Executive (HSE). The HSE makes no distinction between the occupational and social use of mobile phones in terms of health, so its prime responsibility is to assess any risk posed to workers or the public by transmitter masts.[22]

18. The Rt Hon Ms Tessa Jowell MP, Minister for Public Health, and the Department of Health have responsibility for providing advice on the possible health impacts of mobile

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[16] Ev. p. 45.

[17] POST Note 109: *Mobile Phones and Health Risks*, Parliamentary Office of Science and Technology, January 1998.

[18] Article 130-R(2).

[19] Ev. p. 121.

[20] The General Product Safety Regulations 1994 transpose the EC Directive 92/59 on general product safety into UK law.

[21] Ev. p.122.

[22] Ev. p. 80.

phones.[23] Government's principal source of scientific advice on the health impacts of mobile telephony is the National Radiological Protection Board (NRPB).[24]

Maximum Exposure Guidelines

19. The Government recognises guidelines for maximum exposures to microwaves established by the NRPB. These are defined in terms of the maximum energy that can be safely absorbed by a given mass of tissue, otherwise known as the specific energy absorption rate (SAR) and are set at a level designed to prevent any adverse effects from heating.[25] The current NRPB guidelines, established in 1993, stipulate a maximum SAR of 0.1 watts (W) in any 10g of tissue for exposure to the head and 0.4 W/kg for whole body exposure.[26] They are based on the most recent report concerning radiation at mobile phone frequencies from the NRPB's Advisory Group on Non-Ionising Radiation (AGNIR).[27] Other countries operate different, more conservative, guidelines for maximum microwave exposures. For example, the maximum SAR recommended in the USA is 1.6W/kg for exposure to the head.[28]

EU Health Council Recommendation

20. On 8th June 1999 the European Union (EU) Health Council agreed a recommendation, with the support of the UK Government, for limiting exposure to electromagnetic fields thereby establishing, for the first time, EU-wide safety standards for mobile phone emissions.[29] The recommendation was based on the exposure limits recommended by the International Commission on Non-Ionising Radiation Protection (ICNIRP), an independent international body of experts on electromagnetic fields and health.[30] The recommendation proposes limiting public exposure to an SAR of 0.2W per 10g of tissue for the head and 0.08W/kg for the whole body (one fifth of the exposures permitted by the NRPB's guidelines) whilst permissible occupational exposure would remain at the level defined by the NRPB.[31] The recommendation has no effect in law and the Minister told us the Government would not automatically adopt matching guidelines for exposure limits in the UK but would "allow the NRPB to consider the standards, to provide advice and then have proper consideration".[32]

21. The ICNIRP guidelines include a "reduction factor" of five in maximum SAR for the public as opposed to occupational exposure. The NRPB argues that "there is a lack of scientific support for the introduction and choice of these reduction factors" and that the existing UK guidelines of limiting exposure of the public "provide adequate protection ... the health benefits to be obtained from further reductions in exposure have not been demonstrated".[33]

22. The current guidelines for maximum SARs for mobile phones were established before the major increase in frequency and duration of use was envisaged and this has led some to suggest that the NRBP guidelines should be revisited.[34] We agree with the NRPB that there is no validated scientific evidence to justify lower exposure limits. Nevertheless, the extent to which many, including the NRPB itself, are calling for more research, particularly in the area of athermal effects of microwaves, justifies a precautionary reduction in maximum exposure

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[23] Ev. p. 1.

[24] Q. 3; Ev. p. 120.

[25] Ev. p. 12.

[26] NRPB, Board Statement: *Restrictions on Human Exposure to Time-varying Electromagnetic Fields and Radiations*. Documents of the NRPB, vol 4, No. 5, pp 1–63 (1993).

[27] Ev. p. 1.

[28] *See*: Ev. p. 45; Ev. p. 60.

[29] Q. 32.

[30] ICNIRP is a formally recognised non-governmental organisation specialising in non-ionising radiation for the World Health Organization and the International Labour Office.

[31] ICNIRP. *Guidelines for Limiting Exposure to Time Varying Electric, Magnetic and Electromagnetic Fields (up to 300GHz)*. Health Physics, vol 74, No.4, pp 494–522 (1998).

[32] Q. 35.

[33] NRPB, Board Statement: *Advice on the 1998 ICNIRP Guidelines for Limiting Exposure to Time-varying Electric, Magnetic and Electromagnetic Fields (up to 300GHz)*, Documents of the NRPB, vol 10, No. 2 (1999).

[34] Ev. p. 46.

guidelines.[35] As the Minister pointed out, the impact on the industry would be a factor in the Government's decision on whether or not to adopt the EU guidelines. Motorola told us that the EU limits had been expected for some time and therefore many parts of the industry already complied.[36] Similarly, Vodafone told us that they thought that "pretty well all cell sites in the UK will comply today".[37] Therefore, although there is no scientific evidence to indicate significant health risks, **we recommend that the Government adopt the ICNIRP recommended guideline limits for microwave exposure as a precautionary measure. We further recommend that these guidelines be introduced quickly but with a grace period to allow network operators to achieve full compliance.**

SCIENTIFIC ADVICE

The National Radiological Protection Board

23. The NRPB is a statutory body, established under the Radiological Protection Act 1970, charged with advising Government on the health hazards of exposure to radiation for the public, workers who are occupationally exposed, and patients undergoing medical treatment.[38] Its advice covers both ionising and non-ionising radiation. In formulating its advice, the NRPB told us that it not only draws on internal research but also takes account of the work of other national and international organisations and assesses all related research findings.[39]

24. The NRPB distinguishes between ionising and non-ionising radiation in its provision of advice as well as in its organisational structure. With regard to ionising radiation, the NRPB is clear that any level of exposure, however small, may cause harm and so exposure should be avoided and minimised.[40] Mobile phones emit only non-ionising radiation. The NRPB guidance on limiting exposure to non-ionising radiation sets a threshold below which the thermal effects of the radiation are considered to be harmless.[41] The NRPB does not consider that there is sufficient evidence for adverse athermal health effects of mobile phone radiation to justify considering such effects in its guidelines for maximum exposures.[42] We return to this later (see para 29).

25. The work of the NRPB on non-ionising radiation is informed by the Advisory Group on Non-Ionising Radiation (AGNIR). Since its establishment in 1990, the AGNIR has been chaired by Sir Richard Doll, an eminent epidemiologist. The AGNIR advises the NRPB on the biological effects of non-ionising radiation relevant to human health and on research priorities. Its members are drawn from relevant medical and academic communities.[43]

26. Some witnesses question the NRPB's credibility and the quality of its advice on non-ionising radiation. One pressure group, which alleges that there are health risks posed by electromagnetic fields, told us that NRPB staff had unhealthily close links with the Department of Health and questioned whether they possessed the right balance of expertise.[44] Others claim that the NRPB too often dismisses data on individuals' health complaints as anecdotal and that it appeared "to side with the cellular industry, rallying to their defence on every occasion they are under pressure".[45] Coghill Laboratories suggest that the NRPB spends too small a proportion of its income on non-ionising radiation research and accuses it of deriving income from "arguably suspicious industrial sources". They also criticise the NRPB for doing reviews which omit "important studies not convenient to their views"and of not being respected in the scientific

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[35] NRPB, Board Statement: *Advice on the 1998 ICNIRP Guidelines for Limiting Exposure to Time-varying Electric, Magnetic and Electromagnetic Fields (up to 300GHz)*, Documents of the NRPB, vol 10, No. 2 (1999).

[36] Q. 33; Q. 164.

[37] Q. 159.

[38] Ev. p. 11.

[39] Ev. p. 12; See also Q. 43.

[40] Q. 61.

[41] Q. 61.

[42] Q. 65.

[43] Ev. p. 11. The membership of the AGNIR can be found in Annex 1.

[44] Ev. p. 59.

[45] Ev. p. 84.

community.[46] Mr Phil Willis MP told us that the NRPB "does not enjoy widespread public confidence" and is "not seen as independent because it advises both industry and the Government".[47]

27. In contrast, a number of witnesses held the NRPB in high regard. The Chief Medical Officer told us that he reviewed NRPB advice, along with colleagues and other individuals "eminent in the field" and found it to be of high quality.[48] The Minister told us that "the NRPB is an expert body with some of the most eminent people in the field".[49] The Federation of the Electronics Industry (FEI) told us that the NRPB's staff included "internationally renowned experts who have a great deal of experience".[50] The NRPB's advice in this area is broadly consistent with that of major international organisations.[51]

28. **We reject the main criticisms of NRPB. Whilst the NRPB's guidelines for maximum microwave exposures are significantly higher than those found in some other countries, their scientific justification is largely unchallenged. Other bodies, including the ICNIRP, a European Expert Group and the World Health Organisation (WHO), agree with the NRPB's assessment that there is no scientific basis for exposure limits to avoid potential harm from athermal effects of microwaves.**

29. We do note that there is a range of evidence suggesting possible athermal effects of microwaves. Some of this evidence, while as yet not replicated, has been properly peer reviewed and published in respected scientific journals.[52] The NRPB has acknowledged that many uncertainties remain in this area and has supported calls for further research.[53] **We recommend that the NRBP regularly reviews the scientific evidence for athermal effects.**

TRANSMITTER BASE STATIONS

30. In the main, public anxiety has centred on transmitter base stations, particularly those sited in residential areas and on school buildings but there is little evidence to support claims that these have any adverse health impacts. Either because of the height of the masts on the roofs of buildings or because at ground level they are fenced off, the attenuated radiation to anyone passing would be well within safety limits.

The Independent Expert Group on Mobile Phones

31. In April 1999, the Minister announced that, in response to recent research publications, the now widespread use of mobile phones and "the heightened public concern about health effects from mobile phones", the NRPB had been instructed to establish an Independent Expert Group on Mobile Phones to assess rigorously the current state of research into the health impacts of mobile phones.[54] It will also identify priority areas for new research, provide an independent risk assessment and advise on the implications of new developments.[55] The membership and terms of reference of the Expert Group were recently announced.[56] Scientific advice in this area is normally provided by the AGNIR via the NRBP. The Department of Health explained that the AGNIR was not expected to finish its current work on exposures to powerline frequencies quickly enough to be able to address the mobile phones issue with sufficient urgency.[57] Nevertheless, the fact that the Government needed to establish an additional body does suggest

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[46] Ev. p. 92.

[47] Ev. p. 123.

[48] Q. 5.

[49] Q. 14.

[50] Ev. p. 21. For example, see also: Ev. p. 24; Ev. p. 76.

[51] Ev. p. 15.

[52] For example, see:Lai, H. and Singh, NP. *Bioelectromagnetics,* vol 16, pp 207–210, (1995).

[53] Ev. p. 13.

[54] Ev. p. 2; Department of Health, press release 8 April 1999.

[55] Department of Health, press release 8 April 1999.

[56] NRPB Press release, 24 August 1999. The membership and terms of reference for the Working Group are in Annex 2.

[57] Ev. pp. 2-3.

that the existing mechanisms were unsatisfactory. **The establishment of the Expert Group on Mobile Phones is a highly appropriate response from Government but we view it as a temporary measure. In the long term, Government and the NRBP must ensure that the AGNIR has sufficient resources to discharge its duties effectively and in a timely manner. We regard this as a responsible recognition by Government that constant vigilance is required in a rapidly changing field.**

32. When the establishment of the Expert Group was first announced, the Minister stated that its membership would be "drawn from the relevant scientific fields, consumers and the industry".[58] In evidence to us, however, she stated clearly "that we should not have representatives of the industry on the advisory group, but that the advisory group should certainly consult with industry".[59] We are disappointed by this change of heart. If the integrity of scientific advisory bodies is brought into question by the inclusion of industrial participants, the appropriate response from Government should be to defend that integrity and to be prepared to justify its selection of candidates. As we have said before, if the Government is to have access to the best scientific advice—which it must—it is vital that appointments to scientific advisory bodies are made on the basis of suitability and relevant expertise rather than on the basis of representation of interest groups.[60] **We recommend that, while they should not be in the majority on the proposed Expert Group, if industrial representatives have useful, relevant expertise, they should be included.**

33. The Minister does, however, intend to include consumer representation on the Expert Group. The Chief Scientific Adviser has explicitly set out the "need to involve at least some experts from other, not necessarily scientific, disciplines, to ensure that the evidence is subjected to a sufficiently questioning review from a wide ranging set of viewpoints".[61] Experience demonstrates that the inclusion of lay members on scientific advisory bodies can be beneficial, challenging the ways in which scientists approach issues and serving as witnesses to their independence and robustness.[62] We recognise that lay members add value to scientific committee deliberations by bringing alternative perspectives. We note that of the ten members of the Expert Group, only one is designated as a lay member. **We recommend that there should be at last two lay members of the Expert Group, as recommended in our previous report.** [63]

34. We have previously recorded our unease over the way in which the rôle of lay members is defined and acknowledged.[64] The Department of Health's use of the term 'consumer representative', in evidence to us, prompts us to do so again. We were pleased to note that in announcing the membership of the Expert Group, the term 'lay member' was used. The term 'consumer representative' is unhelpful; it may serve to give the false impression that it is part of a scientific advisory body's remit to take consumer interests into account. It may also suggest that all consumer concerns have been taken adequately into account—which is not so. The Minister told us that in seeking a consumer representative for this Group she would draw "from a pool of people who are used to representing the public interest and have a track record as champions of the consumer interest".[65] We do not accept the suggestion that consumer representatives are better placed to serve the public interest than others. All members of scientific advisory committees should be expected to serve the public interest on an equal basis. **Greater clarity in the rôle of lay members on advisory bodies and working groups is required. We recommend that their rôle be clearly set out, in advance of appointment, in**

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[58] Department of Health, press release 8 April 1999.

[59] Q. 15.

[60] *See*: *Scientific Advisory System: Genetically Modified Foods,* Science and Technology Committee, First Report, Session 1998-99, HC 286–I, para 47.

[61] Sir Robert May, *The Use of Scientific Advice in Policy Making*, Office of Science and Technology, March 1997, para 6.iv.

[62] *Scientific Advisory System: Genetically Modified Foods,* Science and Technology Committee, First Report, Session 1998-99, HC 286–I, para. 53.

[63] *Scientific Advisory System: Genetically Modified Foods,* Science and Technology Committee, First Report, Session 1998-99, HC 286–I, para. 53.

[64] *Scientific Advisory System: Genetically Modified Foods,* Science and Technology Committee, First Report, Session 1998-99, HC 286–I, para. 54.

[65] Q. 16.

terms of bringing alternative perspectives to bear and holding up scientific assumptions to proper scrutiny. To perform effectively lay members may need some specialist knowledge. The rationale for their appointment must be made clear.

The Need for Research

35. Several epidemiological and experimental studies have investigated the possibility of links between RF radiation and cancer.[66] While there is no proven mechanism for such radiation to cause cancer, even though some may be postulated, these observations continue. Most published and peer-reviewed work in this area has failed to show any link and the work which *has* demonstrated statistically significant links has not been replicated.[67] The Royal Society of Canada has concluded that the data did "not support a hypothesis of an association between exposure to radiofrequency fields and risk of cancer, reproductive problems, or congenital abnormalities".[68] However, the report did point to one recent study—that of Lai and Singh which found DNA fragmentation in rats exposed to RF radiation[69]—and suggested that this should be "taken seriously as an indication of the potential genotoxicity of RF fields"; however several other laboratories' repeated attempts to reproduce these results have failed.[70] The NRPB has reached a broadly similar conclusion but has also pointed out that lack of evidence does not prove absence of risk and argues that further research is required.[71] **We agree that there is a "need to confirm or deny the work on microwave-induced DNA fragmentation".[72] We note with approval that industry is co-operating with the WHO and the EU's fifth framework programme to determine priorities for a collaborative research programme to examine athermal effects of non-ionising radiation and endorse the need for this.**

36. Indications of athermal harmful effects from mobile phones are, however, speculative or anecdotal. For instance, Dr Gerard Hyland, a theoretical physicist from the University of Warwick, is concerned that current safety guidelines do not account for the impact which pulsed microwaves might have on living tissues, especially those of the nervous system. He suggests that there may be potential for the 217 Hz pulsed signal from digital GSM phones, which is in the range of brain alpha waves, to have an adverse impact on neurological function.[73] One company which manufactures and markets a product designed to reduce absorption levels, has "recorded details of thousands of users complaining of a range of symptoms which they blame on their mobile".[74] Anecdotal evidence can, however, usefully serve to target further scientific research. **We agree with the Royal Society of Canada that the evidence for neurological problems reportedly caused by mobile phones, including symptoms such as headache, nausea, tiredness, sleep problems and memory loss, is unclear but there is sufficient anecdotal evidence and uncertainty to justify further research.[75]**

37. If the Government is to receive effective scientific advice, then that advice needs to be based on a sound body of research-based, peer-reviewed evidence. The Medical Research Council (MRC) funds no research at present into the health aspects of mobile phones, radio waves or non-ionising radiation, although it told us that it would welcome good quality research proposals in this area.[76] The Minister told us that the extent of Department of Health funding for research in this area is £60,000. The NRPB budget for microwave frequency research in

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[66] *See*: Ev. p. 63.

[67] *See*: *Moulder et al*, *Radiation Research*, vol 151, pp 513–531, 1999.

[68] The Royal Society of Canada, *A Review of the Potential Health Risks of Radiofrequency Fields From Wireless Telecommunication Devices*, March 1999.

[69] Lai, H. and Singh, NP, *Bioelectromagnetics*, vol 16, pp 207–210, (1995)

[70] The Royal Society of Canada, *A Review of the Potential Health Risks of Radiofrequency Fields From Wireless Telecommunication Devices*, March 1999.

[71] Ev. p. 12.

[72] Ev. p. 46.

[73] Ev. p. 88.

[74] Ev. p. 83.

[75] The Royal Society of Canada, *A Review of the Potential Health Risks of Radiofrequency Fields From Wireless Telecommunication Devices*, March 1999.

[76] Ev. pp. 97-98.

1999/2000 is just £300,000.[77] The Minister accepts that the "research programme in this area is very small and inadequate to service the need for further scientific and public knowledge".[78] We note that mobile operators pay substantial licence fees to the Radiocommunications Agency for the use of their radio spectrum and also that the Government expects to raise around £1 billion from the UMTS spectrum auction next year.[79] **We believe that the level of publicly-funded research into the effects of microwave emissions falls short of an adequate programme into an area where public health implications should be regularly reviewed. We recommend that the Government ensures that a higher priority is given to a research programme into the health impacts of mobile phones. The public health aspects of new technologies should be incorporated into the Foresight Programme.**

Industrial Research

38. The mobile phone industry itself makes a major contribution to research relating to microwave absorption. (An example of this can be seen in a recent industry/university LINK project which developed a technique for measuring the SAR in the human head from mobile phones.)[80] The GSM Association, which represents all GSM network operators worldwide, contributes funds to the WHO Electromagnetic Field (EMF) project and expects to provide £3 million over the next 5 years.[81] It also plans to fund 25% of the European Fifth Framework Programme into mobile phone safety.[82] Worldwide, the industry estimates that it has to date spent some $50-60 million on research into the health effects of mobile phone systems.[83] This represents a significant research effort and, while much of that spending is directed towards external research, a proportion is also undertaken in-house which means that some valuable expertise and knowledge rests in industry itself.[84] In many cases, co-operation from network operators or manufactures will be essential to the success of a research project—such as epidemiological studies which require data on mobile phone usage.[85] Global co-ordination of research efforts, such as that supported jointly by the Mobile Manufacturers' Forum Research Planning Committee and the WHO, can remove unnecessary duplication and ensure that every aspect is addressed.

39. As Vodafone and Motorola point out, however, the industry's credibility in exploring the safety of its products itself is limited.[86] Industrial research needs to be complemented by the work of the WHO and corroborated by research undertaken by others through the Research Councils. **It is essential that there is an independent and appropriately-funded research programme which is seen to be objective and which is seen not to be directed by commercial interests, even if industry makes a contribution to the funding.**

Reducing Microwave Absorption

40. Some mobile phone users, in response to reported uncertainties about the radiation effects, have chosen to use additional devices, which purport to reduce absorption, as a precautionary measure. Both the NRPB and Vodafone questioned the effectiveness of protective shields—devices which fit around phones—which are designed to reduce the levels of radiation reaching the head. The NRPB told us that these devices will reduce the ability of the phone to communicate with the base station and so the phone will increase the transmission power, resulting in the same level of exposure.[87] Vodafone said that shields are "setting out to defeat

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[77] Ev. p. 127.

[78] Q. 22.

[79] Ev. p. 76.

[80] *See*: Ev. p. 31.

[81] Ev. p. 31.

[82] Ev. p. 57.

[83] Ev. p. 76.

[84] Ev. p. 26.

[85] Ev. p. 46.

[86] Ev. p. 3; Ev. p. 27.

[87] Q. 53.

the purpose for which the product is designed".[88] One manufacturer of such shields, however, strongly refuted the suggestion that their product was ineffective.[89] Hands-free kits allow mobile phones to be used away from the head and so can reduce the amount of radiation reaching the head. This is likely to increase the amount of radiation reaching other parts of the body, depending on where the handset is held. Motorola told us that these devices are bought "as least as much for comfort in prolonged use" as they are for health reasons.[90] Handset SARs vary from model to model.[91] Vodafone told us that "with advances in antenna design, it is possible to direct more of the signal towards the radio base station", thus reducing the SAR.[92] **We recommend that the industry and the NRPB explore ways in which the design of mobile phones might limit personal exposure to radiation as a means of assisting consumer choice.**

CONCLUSIONS

41. Mobile phone technology is delivering significant benefits to the consumer and the UK economy as a whole. Validated scientific evidence supports the conclusion that neither mobile phones nor their associated base stations, if they comply with current maximum exposure guidelines as they appear to do, present a health hazard. Uncertainties, however, remain. Some scientific results, albeit unreplicated, and anecdotal evidence, underline the need for further research. The Government's own research programme falls seriously short of adequacy and is insufficient to underpin its policy decisions. We therefore call for an expanded research programme to provide for a regular review of the public health implications of mobile phone technology. The implementation of our recommendations should help to achieve this.

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[88] Q. 110.

[89] Ev. p. 84.

[90] Q. 112.

[91] Ev. p. 73.

[92] Ev. p. 32. *See also*: Ev. p. 46.

ANNEX 1

Membership of the Advisory Group on Non-Ionising Radiation

Sir Richard Doll, Chairman, Imperial Cancer Research Fund Cancer Studies Unit, Oxford
Professor C Blakemore, University of Oxford
Professor E H Grant, Microwave Consultants Limited, London
Professor D G Harnden, Wythenshawe Hospital, Manchester
Professor J M Harrington, Institute of Occupational Health, Birmingham
Professor T W Meade, St Bartholomew's and Royal London Medical School, London
Professor A J Swerdlow, London School of Hygiene and Tropical Medicine

Observers:

Mr G Hooker, Department of Health
Mr H Walker, Department of Health

ANNEX 2

Terms of Reference and Membership of the Independent Expert Group on Mobile Phones

Terms of reference:

"*To consider present concerns about the possible health effects from the use of mobile phones, base stations and transmitters, to conduct a rigorous assessment of existing research and to give advice based on the present state of knowledge. To make recommendations of further work that should be carried out to improve the basis for sound advice*".

Chairman:

Professor Sir William Stewart FRS, Chairman, Tayside University Hospitals NHS Trust, Dundee

Members:

Professor C Blakemore FRS, neurophysiologist, University of Oxford
Professor L Challis, physicist, University of Nottingham
Professor D Coggan, environmental epidemiologist, MRC
Professor Sir David Cox FRS, statistician and epidemiologist, University of Oxford
Mr J Fellows, student, lay member
Dr M Repacholi, experimental scientist, Head of the WHO EMF Programme
Professor M Rugg, risk perception, Institute of Cognitive Neuroscience
Professor A Swerdlow, epidemiologist, London School of Hygiene and Tropical Medicine
Mr T Varma, neurosurgeon, Walton Centre for Neurology and Neurosurgery, Liverpool

Observers:

Dr A Baddeley, University of Bristol and NRPB
Dr H Walker, Department of Health
Mr G Worsley, DTI

GLOSSARY

AGNIR	Advisory Group on Non-Ionising Radiation
DNA	Deoxyribonucleic acid
DTI	Department of Trade and Industry
EU	European Union
EMF	Electromagnetic field
FEI	Federation of the Electronics Industry
GSM	Global System Mobile
HSE	Health and Safety Executive
ICNIRP	International Commission on Non-Ionising Radiation Protection
MHz	Megahertz
MMF	Mobile Manufacturers' Forum
NRPB	National Radiological Protection Board
RF	Radio frequency
SAR	Specific absorption rate
UMTS	Universal Mobile Telephony System
WHO	World Health Organisation

PROCEEDINGS OF THE COMMITTEE RELATING TO THE REPORT

THURSDAY 2 SEPTEMBER 1999

Members present:

Dr Michael Clark, in the Chair

Mr Nigel Beard
Dr Ian Gibson
Dr Lynne Jones
Mr Ian Taylor

The Committee deliberated.

Draft Report (Scientific Advisory System: Mobile Phones and Health), proposed by the Chairman, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs Nos. 1 to 41 read and agreed to.
Annexes read and agreed to.

Resolved, That the Report be the Third Report of the Committee to the House.

Ordered, That the Chairman do make the Report to the House.

Ordered, That the provisions of Standing Order No. 134 (Select committees (reports)) be applied to the Report.

Several Papers were ordered to be appended to the Minutes of Evidence.

Ordered, That the Appendices to the Minutes of Evidence taken before the Committee be reported to the House.

Several Papers were reported to the House.

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MOTOROLA LTD

Mr David Brown and Dr Quirino Balzano 33

VODAFONE GROUP PLC

Mr Tim Harrabin and Mr Mike Pinches 33

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1. Annex to Memorandum submitted by the National Radiological Protection Board
2. Annex to Memorandum submitted by the Department of Health
3. Appendices to Memorandum submitted by Northern Ireland Families Against Telecommunication Transmitter Siting
4. Appendices to Memorandum submitted by Orange Personal Communication Services Ltd
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7. Appendices to Memorandum submitted by Mr Stewart Anthony Fist
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